



**U.S. NUCLEAR REGULATORY COMMISSION**  
**STANDARD REVIEW PLAN**  
**OFFICE OF NUCLEAR REACTOR REGULATION**

**3.5.2 STRUCTURES, SYSTEMS, AND COMPONENTS TO BE PROTECTED FROM EXTERNALLY GENERATED MISSILES**

**REVIEW RESPONSIBILITIES**

Primary - Auxiliary Systems Branch (ASB)

Secondary - None

**I. AREAS OF REVIEW**

The ASB review of the structures, systems, and components (SSC) to be protected from externally generated missiles includes all safety-related SSC on the plant site that have been provided to support the reactor facility. These include such elements as essential service water intakes, buried components (e.g., essential service water piping, storage tanks), and access openings and penetrations in structures.

The ASB reviews the functional operations or performance requirements for SSC to assure conformance with the requirements of General Design Criteria 2 and 4 and identifies the SSC that are necessary for the safe shutdown of the reactor facility and the SSC whose failure could result in a significant release of radioactivity. Safety-related SSC are reviewed with respect to their capability to perform functions required for attaining and maintaining a safe shutdown condition during normal or accident conditions, mitigating the consequences of an accident, or preventing the occurrence of an accident assuming impact from externally generated missiles. If the turbine is not properly oriented, AEB will request ASB to also review the protection of SSC from the effects of turbine missiles.

Based on their relation to safety, structures or areas of structures, systems or portions of systems, and components are identified as requiring protection from externally generated missiles if a missile could prevent the intended safety function, or if as a result of missile impact on a nonsafety-related SSC, its failure could degrade the intended safety function of a safety-related SSC. The SEB will determine the acceptability of barriers and structures designed to withstand externally generated missiles as part of its primary responsibility for SRP Section 3.5.3.

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**USNRC STANDARD REVIEW PLAN**

Standard review plans are prepared for the guidance of the Office of Nuclear Reactor Regulation staff responsible for the review of applications to construct and operate nuclear power plants. These documents are made available to the public as part of the Commission's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Standard review plans are not substitutes for regulatory guides or the Commission's regulations and compliance with them is not required. The standard review plan sections are keyed to the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants. Not all sections of the Standard Format have a corresponding review plan.

Published standard review plans will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience.

Comments and suggestions for improvement will be considered and should be sent to the U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. 20555.

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## II. ACCEPTANCE CRITERIA

Acceptability of the list of SSC to be protected against externally generated missiles, presented in the applicant's safety analysis report (SAR), is based on specific general design criteria and regulatory guides.

The identification of structures, systems, and components to be protected against externally generated missiles is acceptable if it is in accordance with General Design Criterion 2, with respect to protection of SSC important to safety from the effects of natural phenomena and General Design Criterion 4, with respect to protection of SSC important to safety against the effects of externally generated missiles to maintain their essential safety functions. Acceptance is based on the design meeting the guidelines of Regulatory Guide 1.13, as related to the spent fuel pool systems and structures being capable of withstanding the effects of externally generated missiles and preventing missiles from contacting stored fuel assemblies; Regulatory Guide 1.27, as related to the ultimate heat sink and connecting conduits being capable of withstanding the effects of externally generated missiles; Regulatory Guide 1.115, as related to the protection of SSC important to safety from the effects of turbine missiles; and Regulatory Guide 1.117, as related to the protection of SSC important to safety from the effects of tornado missiles.

## III. REVIEW PROCEDURES

The procedures set forth below are used during the construction permit (CP) review to determine that the applicant's list of SSC that require protection from externally generated missiles is complete and meets the acceptance criteria given in subsection II of this SRP section. For operating license (OL) applications, the procedures are used to verify that the CP-stage list continues to be applicable and complete, or has been supplemented as appropriate. The reviewer will select and emphasize material from the paragraphs below, as may be appropriate for a particular case.

The first step in the review is to verify the identification of the safety-related SSC, and whether the SSC are considered safety related in their entirety or have only portions that are safety related. In order to determine the safety category of the SSC, the ASB evaluates the SSC of the facility with respect to their necessity for achieving and maintaining safe reactor shutdown, and for performing accident prevention or mitigation functions. The information provided in the SAR pertaining to SSC design bases, design criteria, descriptions and safety evaluations, together with the system and component characteristic tables and safety classification tables are reviewed to identify safety functions performed by the SSC. In general, the safety functions to be performed by the SSC in various designs remain essentially the same. However, the location or arrangement of the SSC and the methods used vary from plant to plant depending upon the individual designer. The reviewer identifies variations in design and evaluates them on a case-by-case basis.

The second step in the review is to determine the SSC, or portions of SSC, that require protection against externally generated missiles. The reviewer uses engineering judgment and the results of failure modes and effects analyses in conjunction with the results of reviews under other SRP sections for specific SSC in determining the need for missile protection. Most safety-related systems are located within structures that are resistant to external missiles by virtue of design for other purposes (e.g., primary containment),

or because the structures are constructed specifically to withstand missiles. Systems and components located within such structures are considered adequately protected. The reviewer concentrates his attention on safety-related SSC located outside such structures and on penetrations and access openings in the structures. Essential service water piping and components, storage tanks, and ultimate heat sink components are examples of SSC typically located outside missile-resistant structures. Depending on the nature and source of the externally generated missiles, protection may be provided by missile barriers for individual components, by locating independent redundant systems in compartments located in a missile protected structure, or by subgrade location at a sufficient depth. Physical separation alone is not normally an acceptable method of missile protection for redundant safety-related systems and components located in nonmissile protected independent structures. Specific missile sources and the protection needed are considered in other SRP sections in the 3.5.1 series.

The reviewer determines that nonsafety-related SSC are identified as requiring protection from externally generated missiles if as a result of their failure by a missile, the consequences could prevent the intended safety function of a safety-related SSC.

#### IV. EVALUATION FINDINGS

The reviewer verifies that sufficient information has been provided and his review supports conclusions of the following type, to be included in the staff's safety evaluation report:

The review of the SSC to be protected from externally generated missiles included all safety-related structures, systems, and components provided to support the reactor facility. Based on the review of the applicant's proposed design criteria, design bases, and safety classifications for SSC necessary for safe reactor shutdown, the staff concludes that the SSC to be protected from externally generated missiles are in conformance with General Design Criteria 2 and 4. This conclusion is based on the following:

The applicant has met the requirements of General Design Criteria 2 and 4 with respect to protection of SSC important to safety against the effects of externally generated missiles by:

- (1) Meeting Regulatory Position C.2 of Regulatory Guide 1.13, "Spent Fuel Storage Facility Design Basis," by preventing missiles generated by tornado winds from causing significant loss of watertight integrity of the fuel storage pool, and from contacting fuel within the pool;
- (2) Meeting Regulatory Position C.2 and C.3 of Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," so that the ultimate heat sink is capable of withstanding the effects of external missiles generated by natural phenomena;
- (3) Meeting Regulatory Position C.1 in Regulatory Guide 1.115, "Protection Against Low Trajectory Turbine Missiles," such that essential systems are protected from low-trajectory turbine

missiles either by proper turbine orientation or by missile barriers;

- (4) Meeting Regulatory Positions C.1, 2, and 3 and the appendix to Regulatory Guide 1.117, "Tornado Design Classification," such that SSC important to safety are protected from the effects of missiles generated by the Design Basis Tornado by providing missile barriers for individual components, locating independent redundant systems or components in missile protected structures or by underground locations at a depth sufficient to protect against missiles; and
- (5) Identifying all SSC requiring protection against the effects of externally generated missiles.

## V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides.

## VI. REFERENCES

1. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."
2. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Missile Design Bases."
3. Regulatory Guide 1.3, "Fuel Storage Facility Design Basis."
4. Regulatory Guide 1.27, "Ultimate Heat Sink."
5. Regulatory Guide 1.115, "Protection Against Low-Trajectory Turbine Missiles."
6. Regulatory Guide 1.117, "Tornado Design Classification."